REPORT RESUMES

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AUTOMOBILE BODY AND FENDER REPAIR AND REFINISHING, A STUDY GUIDE AND PROGRESSION RECORD IN AUTOMOBILE BODY AND FENDER REPAIR AND REFINISHING.

ALABAMA UNIV., UNIVERSITY

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JOB SHEETS ARE USED IN THIS INDIVIDUAL STUDY GUIDE TO DIRECT GRADE 11 AND GRADE 12 STUDENTS IN COOPERATIVE EDUCATION PROGRAMS IN AREA VOCATIONAL OR COMPREHENSIVE HIGH SCHOOLS. THE GUIDE WAS DEVELOPED BY A STATE COMMITTEE OF TRADE AND INDUSTRIAL COORDINATORS, SUBJECT MATTER SPECIALISTS, AND TEACHER EDUCATORS, AND HAS BEEN USED IN HIGH SCHOOL PROGRAMS FOR 30 YEARS. THE JOB SHEETS CONTAIN THE JOB TITLE, RELATED STUDY REFERENCES, QUESTIONS, AND A CHART FOR RECORDING COMPLETION OF CORRELATED LABORATORY PERFORMANCES AND RELATED REFERENCES. TRADE ANALYSIS AND PROGRESS RECORD FORMS FOR TEACHER AND STUDENT USE INCLUDE A LIST OF THE JOB SHEETS AND SPACES FOR RECORDING PROGRESS ON THE JOB AND IN RELATED STUDY. ALSO INCLUDED IS A STUDENT'S DAILY RECORD FORM. TIME ALLOTMENT IS 1 HOUR PER DAY FOR 2 YEARS OR 360 HOURS. A BIBLIOGRAPHY INCLUDES REQUIRED TEXTS AND SUPPLEMENTARY REFERENCES. THIS DOCUMENT IS AVAILABLE FOR $1.25 FROM TRADE AND INDUSTRIAL EDUCATION, BOX 2847, UNIVERSITY, ALABAMA 35486. AN ANSWER BOOK (VT 002 388) IS AVAILABLE FOR $1.00. (HC)

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AUTO BODY AND FENDER REPAIR

VT002376

FILE NO. 316

AUTOMOBILE BODY AND FENDER REPAIR
AND REFINISHING

A study guide and progression
record in Automobile Body and
Fender Repair and Refinishing

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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Prepared by

A Committee of
Alabama Trade and Industrial
Education Coordinators Working
with Competent Consultants

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University of Alabama
University, Alabama

Revised

February, 1966

AUTOMOBILE BODY AND FENDER REPAIR

AND REFINISHING

BIBLIOGRAPHY

ACW	Automotive Collision Work, Venk, Spicer, Davies, American Technical Society, 848 East 58th Street, Chicago, Illinois, 60637 Price $5.56
ARR	Auto Body Repairing and Repainting, Bill Toboldt, Goodheart-Willcox Company, 18250 Harwood Avenue, Homewood, Illinois, 60430 Price $4.31
ASM	Automobile Sheet Metal Repair, Robert L. Sargent, Chilton Company, Book Division, 5605 Chestnut Street, Philadelphia 39, Pennsylvania, Price $6.06
OAH	The Oxy-Acetylene Handbook, Linde Air Products Company, 270 Park Avenue, New York 17, New York Price $2.00
SPC	Spray Painting, F. M. Crewdson, Frederick J. Drake Company, 7312 N. Ridgeway Avenue, Skokie, Illinois, 60076 Price $3.00

SUPPLEMENTARY REFERENCES

Automotive Refinishing Paint Shop Manual, E. I. Dupont De Nemours, Inc., Wilmington 96, Delaware

The Key to Metal Bumping, Fairmont Tool and Forging Company, 1061 Quincey Avenue, Cleveland, Ohio

Martin Senour's Automotive Color Directory, Martin Senour Company, 2500 South Senour Avenue, Chicago 8, Illinois

Motor's Flat Rate Manual, Motors, 250 West 55th Street, New York 19, New York

Plasto Bond Shop Manual, Swiss Laboratories, Inc. Cleveland 14, Ohio

ARCO, The ARCO Company, Division of Mobil Finishes Company, Inc., 7301 Bessemer Ave., Cleveland, Ohio, 44127

HOW TO USE THIS STUDY GUIDE AND RECORD OF PROGRESS

The student's record of progress is kept on the Trade Analysis and Progress Record page. Progress "on-the-job" is kept in the column headed "Job Progress", and related study progress is kept in the adjoining column headed "Related Study".

The four step method of training is used in developing the skills of a trade or occuaption. A record of all these steps for each job is kept in the squares in the column below "Learning Status" (Steps), opposite a specific job.

⊡ A dot in the center of the square indicates a student is in the first step; that of observing the job being done. No other mark is made in this square as long as the student remains in this step.

⧄ A diagonal line across the same square indicates the student is in the second step; that of helping perform the job under instruction.

⊠ Two diagonal lines across the same square indicates that the student is in the third step; that of doing the job under supervision.

▨ The square filled in solid indicates that the student has reached the fourth step; that of a satisfactory level of accomplishment. The date when this accomplishment has been reached is placed in the column "Date Objective Reached", opposite the specific job.

On the day the student has read all the references and has written the answers to all of the questions, for a specific job, the student places this date in the column headed "Date Completed", opposite this job. The grade made on the test on this job is entered in the adjoining square headed "Test Grade".

The word "Information" will be found in the "Job Progress" column for all information lessons. When all references have been read and all answers to the questions have been written, for a specific information lesson, the student places the date of completion in the "Date Completed" column, opposite this lesson number. The grade made on the test on this lesson is entered in the square headed "Test Grade".

The student should read all references before writing the answers to questions. The essay type of answers which are required for most questions have a very definite value as they will help the student form the habit of giving clear-cut, definite answers or explanations. Only a few references and a few questions have been listed on each job sheet to teach the student how to study the literature pertaining to his occupation.

AUTOMOBILE BODY AND FENDER REPAIR AND REFINISHING

TRADE ANALYSIS AND PROGRESS RECORD

NO.	JOBS AND INFORMATION LESSONS	JOB PROGRESS		RELATED STUDY	
		Learning Status (Steps)	Date Objective Reached	Date Completed	Test Grade
1.	History of Body and Frame Construction	Information			
2.	Selecting and Caring for Hand Tools				
3.	Using the Basic Hand Tools				
4.	Selecting and Using Power Tools				
5.	Learning Welding Terms				
6.	Equipping for Welding				
7.	Setting Up an Oxy-acetylene Welding Outfit				
8.	Lighting the Torch				
9.	Observing Safety Rules in Welding				
10.	Making Adjustments for Different Flames				
11.	Operating the Oxy-acetylene Welding Outfit				
12.	Operating Electric Welder				
13.	Spot Welding				
14.	Brazing Metal				
15.	Inspecting and Testing Welds				
16.	Cutting Light Metal with the Oxy-acetylene Torch				
17.	Cutting Heavy Metals with Oxy-acetylene Torch				
18.	Cutting Steel with Oxy-acetylene Torch				
19.	Applying Solder				

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NO.	JOBS AND INFORMATION LESSONS	JOB PROGRESS		RELATED STUDY	
		Learning Status (Steps)	Date Objective Reached	Date Completed	Test Grade
20.	Using Basic Straightening Procedures and Equipment				
21.	Bumping and Dinging Metal				
22.	Shrinking Metal				
23.	Repairing Fenders				
24.	Replacing Door Panels				
25.	Straightening Door				
26.	Aligning and Adjusting Doors				
27.	Applying Fiber Glass and Plastic Filler				
28.	Filling with Body Solder				
29.	Repairing and Servicing the Hood				
30.	Aligning Hoods				
31.	Filing and Sanding				
32.	Understanding the Fundamentals of Frame and Body Layout	Information			
33.	Straightening Frame Damage				
34.	Checking Frame Alignment				
35.	Installing and Servicing Door Glass				
36.	Removing and Installing Windshields				
37.	Replacing and Aligning Roofs				
38.	Removing and Replacing Trim				
39.	Preventing Dust and Water Leaks				

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NO.	JOBS AND INFORMATION LESSONS	JOB PROGRESS		RELATED STUDY	
		Learning Status (Steps)	Date Objective Reached	Date Completed	Test Grade
40.	Servicing Power Seats, Windows and				
	Tops				
41.	Repairing Shields and Hoods				
42.	Straightening the Deck Lid				
43.	Aligning Deck Lid				
44.	Determining When to Repair and When to				
	Replace Parts				
45.	Using Reinforcements in Body Work				
46.	Making Low Cost Short Duration Repairs				
47.	Masking				
48.	Operating Sanders or Grinders				
49.	Removing Old Paint				
50.	Selecting Painting Materials				
51.	Operating the Air Compressor				
52.	Making Spot Repairs				
53.	Operating Spraying Equipment				
54.	Using Proper Technique in Spray Painting				
55.	Preventing Spray Painting Defects				
56.	Using Synthetic Finishing Materials				
57.	Refinishing with Lacquer				
58.	Refinishing Wheels				
58a	Information Sheet				
59.	Refinishing Inside Molding, Instrument				
	Panels, etc.				

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		Learning Status (Steps)	Date Objective Reached	Date Com-pleted	Test Grade
59a	Information Sheet				
60.	Refinishing Metal				
61.	Mixing Paint and Matching Colors				
62.	Estimating the Cost of Auto Body Work				
63.	Repairing Fiber Glass Bodies				
64.	Customizing Auto Bodies				
65.	Servicing Door Hardware				
66.	Recovering Convertible Tops				
67.	Cleaning Upholstery				
68.	Removing and Installing Headlining				
69.	Aligning Wheels				
70.	Maintaining the Auto Body				
71.	Safety in the Auto Body Shop				
72.	Repairing Unitized Bodies				

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3.	Using the Basic Hand Tools				
4.	Selecting and Using Power Tools				
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	Outfit				
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71.	Safety in the Auto Body Shop				
72.	Repairing Unitized Bodies				

NAME______________________ OCCUPATION_______________ AGENCY_________

STUDENT'S DAILY RECORD

Date	List the Job Numbers Performed the Previous afternoon	List the References Read in the Related Class by Symbols and Pages	List the Number of the Job Studied Today

Job 1

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
History of Body and Frame Construction	INF.	ACW 1-68	

1. In the construction of the body and frame of a car, what is of prime importance?

2. Name two types of construction used in automotive vehicles.

3. Explain why the understanding of the construction of the frame is extremely important.

4. Name the different ways a frame can be constructed, starting with the U-channels.

5. What is the passenger carrying compartment of an automobile called?

6. Give in your own words the meaning of outer-construction.

7. Explain the meaning of inner-construction.

8. The instrument panel is usually considered a part of what?

9. Name the parts to which the center body pillar is joined.

10. How are the rear quarter side panels joined to the roof?

11. In some models there are no handles on the rear deck lid. Explain how it is opened.

12. Why should a drop cloth be used when installing glass in an automobile?

13. Some windshields and rear windows are sealant-bonded to what?

14. The weather strip, which is used to secure the windshield glass, is also channeled to receive what?

15. Why do the sheet metal screws have a bright metal head?

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
History of Body and Frame Construction		ACW 1-68	

16. What is the molding used around the window openings in the door called?

17. Where is the vacuum created when the automobile is traveling?

18. Name some of the body panels which are not considered as an integral part of the automobile body.

19. At what points are front fender adjustments usually provided?

Job 2

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Selecting and Caring for Hand Tools		ACW 74-77, 105-114 ASM 53-67	

1. There are how many tools in the minimum kit for the metal bumper?

2. From what material is the mallet head made?

3. Describe the pick hammer.

4. What type jobs require the square face, taper shank head, and molding hammer?

5. Low crown dollys are used in conjunction with bumping hammers, primarily in places where a slight contour is encountered. Name some of these slight contoured sections.

6. Where is use of the high crown dolly required?

7. The surfacing spoon is used with what type hammer?

8. A body file and holder is necessary for what use?

9. What are the three basic purposes of the body spoon?

10. What was the general purpose body spoon originally called?

11. There are many special purpose tools. Name three typical ones.

Job 3

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Using the Basic Hand Tools		ASM 53-67 ARR 18-22	

1. What is applied to the piece of damaged sheet metal to restore it to original shape?

2. Name two very common styles of bumping hammers.

3. What is the distinguishing feature of all bumping hammers?

4. Why are dolly blocks used?

5. Where are dolly blocks normally used?

6. Describe the spoon.

7. Why is the forged end of a spoon used?

8. Spoons are used for how many basic purposes?

9. What is the primary purpose of the bumping spoon?

10. Of what other use is the bumping spoon?

11. Give the basic purposes of the body spoon.

12. What tools are usually made of tempered steel rods?

Job 4

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Selecting and Using Power Tools		ACW 183-211 ARR 41-55	

1. A body jack consists of how many basic units?

2. Name two types of jacks usually used in shops.

3. Describe the direct acting jack.

4. Where is the power dolly usually used?

5. Where are the V-type toggles action spreaders used?

6. Where are the power tools placed for direct and indirect hammering?

7. What is a pneudraulic pump?

8. What is a leverage dolly?

9. What does the mechanical push-pull jack provide?

10. Chain attachments are used primarily on what type jacks?

Job 5

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Learning Welding Terms		ACW 121-124 ASM 137-155 ARR 57-65	

1. What is the welding process?

2. Why is the oxygen and acetylene flame used?

3. With what is the actual welding done?

4. What mixes the acetylene and oxygen and may be considered as the most important part of the welding out-fit?

5. What is a carburizing flame?

6. Describe the results of a clear neutral flame.

7. What is a neutral flame?

8. Describe the results of the molton metal when using a carburizing flame.

9. What is an oxidizing flame?

10. Why whould the slightest trace of excess oxygen be avoided when using the oxidizing flame?

11. What is the difference between oxyacetylene and electric arc welding?

12. List the equipment needed for oxyacetylene welding.

13. What is a flashback?

14. What is brazing?

Job 6

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Equipping for Welding		ACW 123-152 ARR 56-65	

1. What is oxygen and acetylene welding commonly called?

2. What causes the combustion at the tip of the torch?

3. How is acetylene sold?

4. Is oxygen sold by weight or pressure?

5. What six basic safety rules govern the operation of gas welding?

6. What is used to light the gas welding torch?

7. What color is generally used for the oxygen hose?

8. The acetylene hose is generally what color?

9. What kind of flame is caused by using an excess of acetylene?

10. Name four kinds of welding joints that can be used in body sheet metal welding.

Job 7

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Setting Up an Oxyacetylene Welding Outfit		ACW 123-127 ASM 144-148	

1. Of what does the oxyacetylene welding equipment consist?

2. The actual welding is done with what basic unit?

3. What causes the flame at the torch tip?

4. What is the ratio of oxygen and acetylene mixture?

5. What is the first procedure in assembling a gas welding outfit?

6. On the single-stage regulator, what is the important part?

7. What is the difference between the single-stage regulator and the two-stage regulator?

8. What kind of hose is used in gas welding?

9. In what way do hoses for acetylene and those used for oxygen differ?

10. The torch consists of how many basic units?

11. Because oxygen and acetylene are both gases, what is the process commonly called?

Job 8

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Lighting the Torch		ACW 121-138	

1. Why have auto body men found it necessary to learn oxyacetylene welding?

2. How many parts of oxygen are needed to consume one part of acetylene?

3. What is the first procedure in assembling a gas welding out-fit?

4. What determines the selection of the tip to be used?

5. What is usually used to light the torch?

6. How many turns are made on the acetylene valve when lighting the torch?

7. What is the proper flame for most welding?

8. What will permit the flame to burn inside the tip?

9. How should the torch be held to produce the best weld?

10. What type motion should be used in welding light metal?

11. The torch supplies only part of the oxygen needed to burn acetylene, what is the source of the other parts?

Job 9

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Observing Safety Rules in Welding		ACW 123-142 ASM 186-187, 191-197	

1. Before assembling and setting up the welding equipment, what rules concerning its proper use should be learned and always remembered?

2. What is the first procedure in assembling the gas welding outfit?

3. Why must protective measures be taken when working with arc welders?

4. What must be worn to protect one's arms and hands from rays emitted by the arc?

5. The protective shield used to protect eyes and face is made from what materials?

6. What type apron is best to use when working on production jobs?

7. What damage may result from improper use or maintenance of a spot welder?

8. Why must a ground wire be used on portable electric equipment?

9. Name the one special piece of equipment that should be used when using the arc.

10. What fire hazards must be watched for when welding automobile frames?

Job 10

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Making Adjustments for Different Flames		ASM 151-156	

1. What determines the exact pressures to which the oxygen and acetylene should be adjusted?

2. What will be the results if the gas flows too fast?

3. What will be the results if the gas flows too slow?

4. How can a welder tell when the flame enters the mixing head of the torch?

5. Why is it best to avoid using the yellow flame?

6. How wide should the acetylene valve be open when lighting the torch?

7. Name the three basic flames.

8. How can a neutral flame be recognized?

9. How can a carburizing flame be recognized?

10. Which flame should not be used to weld steel?

Job 11

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Operating the Oxy-Acetylene Welding Out Fit		ASM 156-169	

1. How should the flame be held when welding light metal to heavy metal?
2. Weaving the flame from side to side will spread the heat and leave what kind of results?
3. How is the position of the filler rod determined?
4. What is meant by proper alignment of the edges?
5. Why is tack welding necessary?
6. Explain what is meant by welding a seam.
7. Why is the inside corner weld so difficult to make?
8. Unless extra care is taken when making the inside corner weld, what will happen?
9. Explain how to make a button hole weld.
10. Name two angles of the flame which must be considered in determining proper one for the work.

Job 12

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Operating Electric Welder		ACW 138-155 ASM 187-196 ARR 61-64	

1. What is the chief draw back limiting the use of Arc welding on sheet metal?

2. In making a butt joint, what must be done and why?

3. Describe the process of striking the arc.

4. Name the two basic types of arc welding equipment in general use.

5. What is the advantage of the D. C. Welder?

6. In arc welding what two things govern the quality of the weld?

7. Upon what does the correct length of the arc depend?

8. What is the main point to watch in welding sheet metal?

9. The problems of safety in arc welding fall in two classifications, name them.

10. What is the chipping hammer?

Job 13

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Making Spot Welds		ASM 178-186 ARR 63	

1. What is required to gain skill in the use of a spot welder?

2. Resistance spot welding is the primary welding method used in assembling automobile sheet metal parts. **Why**?

3. What are the most important factors in making a spot weld?

4. List some of the requirements for spot welding.

5. Why are body shops limited to electrode tips with small diameters?

6. What size electrode tip is most common in body shops?

7. What must a spot welder operator, without a timer, depend on to determine proper heat?

8. How can the electrode points be kept in proper operating condition?

9. What is necessary to make a spot weld?

10. If the pressure on the heated surfaces is too great, what will happen?

Job 14

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Brazing Metal		ASM 170-178 ARR 64-65	

1. What is brazing?

2. How does the heat used for brazing compare with the heat for soldering and welding?

3. What kind of rods are used in braze welding?

4. Why are silver base alloys seldom used in body repairing?

5. How are the strongest braze joints made?

6. Brazing flux is usually applied in what form?

7. Why should the metal be clean before brazing?

8. Describe a good brazed joint.

9. What are the results if the temperature is too low?

10. How should the beginner test the quality of his practice joints?

11. Why is much more care and attention required on vertical seams?

12. What method is usually used in applying powdered flux?

13. Why does the molten brazing material flow back through the joint?

14. What is the advantage of braze welding?

Job 15

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Inspecting and Testing Welds		OAH 469-479	

1. What is the purpose of all inspection and testing of welds?
2. The defects in welds can be classified into how many groups?
3. Describe the two methods for examining welds.
4. Name the most familiar and most widely used method for determining the quality of welds.
5. Tell why the Nick-Break Test is used.
6. The Free-Bend Test is used for what purpose?
7. Why is the Guided-Bend Test frequently used?
8. The Hardness testing methods are used in what way?
9. Describe the etch-test.
10. What is provided by the x-ray or radiographic method inspection?

Job 16

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Cutting Light Metal with the Oxyacetylene Torch		OAH 411-416 ARR 67-70	

1. What is oxy-acetylene cutting?

2. How are oxy-acetylene cutting blowpipes constructed?

3. What are the advantages of machine flame-cutting?

4. What is caused by the heat used in cutting?

5. What are the general effects of oxygen cutting on steels that have air-hardening properties?

6. To what group of metals is oxygen cutting confined?

7. How are cutting blow-pipes guided?

8. It has been conslusively proved that the metallurgical effects that result from cutting are due to what?

9. When iron is heated red hot and exposed to high purity oxygen, what takes place?

10. If a steam of oxygen is directed against the white hot edge of a piece of steel, but no additional heat supplied at the same time from an external source, what will happen?

Job 17

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Cutting Heavy Metals with Oxy-acetylene Torch		OAH 458-466 ARR 67-69	

1. Why is the difficulty of cutting with the oxy-acetylene process not proportional to the thickness of the metal cut?

2. What is the effect of too high oxygen pressure when cutting heavy sections?

3. How are holes cut in thick sections?

4. What is an oxygen lance?

5. How is an oxygen lance set up?

6. How does the oxygen lance differ from the cutting blow pipe?

7. Why is it desirable to use two men when cutting with the oxygen lance?

8. The cutting blow pipe operator starts the cut at one side, using what?

9. Whenever possible, heavy sections should be supported and given how much clearance?

10. An oxygen lance and cutting blow pipe are frequently used together. What are their functions?

Job 18

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Cutting Steel with Oxy-acetylene Torch		OAH 417-443	

1. How should material be prepared for oxy-acetylene cutting?

2. What is meant by drag?

3. What is used for removing rivets?

4. What is meant by miter cutting?

5. What is flame-gouging?

6. How does flame-gouging differ from other flame cutting?

7. How should the operator be protected while cutting cast iron?

8. What preheating flame adjustments are used for cutting cast iron?

9. Why do many alloy steels require special consideration for cutting?

10. What is the technique to be used when cutting stainless steel?

Job 19

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Applying Solder		ACW 162-169 ARR 78-79	

1. What is customarily done at automobile body factories when adjoining panels do not exactly match?
2. What is actually the first operation of soldering?
3. What should be done as soon as enough solder has been applied?
4. What is the purpose of paddling solder?
5. If finishing is done while the solder is hot, what will happen?
6. Why is disk grinding not advisable?
7. Body soldering is performed with either an oxy-acetylene torch or a blow torch and is referred to by what name?
8. What is sinking the weld?
9. How much is the seam of a weld sunk before applying solder?
10. If the area being worked on becomes too hot, what will happen?
11. Why should the paddle be covered with a light film of regular engine oil?

Job 20

TYPE JOB	LABORATORY PERFORMANCE					RELATED STUDY REFERENCES	DATE READ
Using Basic Straightening Procedures and Equipment						ASM 228-230, 248-256	

1. Why is roughing the most important phase of the total straightening operation?

2. Name three groups (or phases) which are always required regardless of the procedures followed.

3. Give the three basic methods of applying force to rough out a damaged panel.

4. Name six of the basic shop equipment tools.

5. With what are the standard body clamps equipped?

6. Name the important features of any body jack.

7. Give three features of the standard body clamp.

8. The heavy duty "C" clamp is intended primarily for what use?

9. Give the general use of tension plates.

10. What is the thickness of metal to which the parallel jaw clamp can be adjusted?

Job 21

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Bumping and Dinging Metal		ACW 71-120 ARR 19-20	

1. What is involved in collision work?

2. In body bumping and dinging the use of what tool is a most important factor?

3. What is meant by the terms bumping and dinging?

4. What is the chief difference between dinging and metal bumping?

5. What is the work of metal finishers in automotive plants?

6. What are the basic requirements learning to do metal bumping?

7. How may you become a skilled metal bumper?

8. What is the minimum number of tools used in minor repairs such as dings in fenders?

9. As a metal bumper, what must you be able to restore?

10. What is a good exercise to help you determine whether or not you should attempt to master this trade?

11. Why should the damage on any job be analyzed before starting to bump?

12. Describe a pick hammer.

13. Why is a dolly used?

14. Describe the indirect hammering procedure.

Job 22

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Shrinking Metal		ASM 109-136 ARR 71-73	

1. What is the meaning of shrinking metal?
2. How is the shrinking operation performed?
3. What types of damage require shrinking?
4. What causes a gouge?
5. Describe the process of shrinking a flange.
6. What is the procedure for shrinking a gouge?
7. What is the most common mistake made in shrinking metal?
8. What causes overshrinking?
9. How is a hammer and dolly block used in straightening a light gouge?
10. What is the key to the identification of false stretch area?
11. What should be done to a surface before shrinking is attempted?

Job 23

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Repairing Fenders		ACW 103-105 ASM 287-300	

1. Why should a damaged fender be roughed out as much as possible before it is removed from the car?

2. What is the primary skill to be learned in using the pick hammer?

3. What will direct hammer on dolly blows spaced properly produce?

4. What is the fastest way of working a sharp fold area?

5. What is always formed last on a damaged fender?

6. What tools are generally used to reform flanges and beads?

7. How is a flange reformed?

8. What will happen if the hammer blows are not struck squarely in the center of the anvil area of the dolly block while repairing a flange?

9. What will be necessary if a flange or fender bead is torn?

10. What should be done in cases of reforming a U shaped fender head?

Job 24

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Replacing Door Panels		ASM 312-321 ARR 74-77 ACW 213-220	

1. What is the first step in repairing the door panel in Figure 258 on page 314 ASM?

2. Give the location of a typical condition which is found on almost all damaged door panels where the dented area extends to the edge.

3. How may the exact amount of force to use with a jack be determined?

4. What method is used to prevent damage to the painted surface gripped by the calm jaws?

5. What is the cause of most rusting on the bottom door panels?

6. Should the door be removed when a panel or a portion of a panel is replaced?

7. When is a recessed lap joint used?

8. When is a flange joint used?

9. Where may a butt weld joint be used?

10. When the entire panel is to be replaced, where is the old panel cut?

Job 25

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Straightening Door		ACW 231-235	

1. What is the best method to use in straightening a damaged door?

2. What is the proper tool to use for any job?

3. What device can be used in the first operation of straightening a door?

4. What should one always do when using a rocker action spoon for door straightening?

5. Why should all bumping and welding be done before stretched areas are removed?

6. What should be done after all the roughing, bumping, welding, and shrinking operation?

7. With what do you grind the door after the straightening is done?

8. For what purpose is the pry bar used?

9. What should be used in checking progress with the pick tools?

10. With what should the low spots in a door be filled?

Job 26

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Aligning and Adjusting Doors		ACW 235-253 ARR 93-99	

1. What is meant by misalignment?
2. What is involved in centering a door?
3. How is door alignment checked?
4. When does the striker plate need adjusting?
5. What type of equipment is most commonly used for correcting door contour?
6. How is the contour of a door decreased?
7. If the door opening is suspected of being out of alignment, how should the dimensions be checked?
8. What can be done when a door is known to be in alignment but does not fit the opening in the body?
9. How are the window openings checked to see if they are in alignment?
10. How can the contour of a door be increased?
11. Describe a correctly positioned Chrysler type striker plate.
12. How can the door weather strip seal be tested?

Job 27

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Applying Fiber Glass and Plastic Filler		ACW 341-342 ASM 219-226 ARR 78-82	

1. When a hole or tear in the metal is mended, it should be backed with what?

2. What will the metal be likely to do if plastic filler is anchored on metal that has been softened or weakened by rust?

3. If lead is selected as a body filler, how many steps should be followed?

4. What body filler calls for the use of acid core?

5. What is used to neutralize the leaded area?

6. What is the first step in preparing the plastic?

7. What is one of the disadvantages in using plastic?

8. What tool can be used for finishing plastic?

9. What tool is particularly desirable when sanding large areas?

10. List five areas of an auto body for which plastic filler may be used.

11. What must be done to fiber glass patches before they are applied to the auto body?

12. What must be done to any area before attempting to apply plastic?

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Filling with Body Solder		ASM 203-217	

1. Why must the beginning body man be cautioned about the use of filling materials?
2. Why is body solder used on automobile bodies?
3. Where may body filling be used?
4. Where should body solder not be used?
5. What are the four basic steps in applying body solder?
6. Why should the metal be cleaned before applying solder?
7. What is tinning?
8. Explain filling and shaping in the terms of applying solder.
9. What is the most frequently used method for adding solder?
10. Why is use of the disc sander on solder not recommended?
11. What must the operator do to maintain the proper temperature while applying solder?
12. When should rapid cooling by quenching with water be done?
13. Why is Flux of some sort essential for soldering on almost all metals?
14. How does the metal finishing of solder differ from that on sheet metal?

Job 29

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Repairing and Servicing the Hood		ACW 253-264 ARR 88-92	

1. When damage occurs to the hood you will find that the hood flange will crack. What is the first step in repairing this damage?

2. Why should the utmost care be exercized to see that the surface is perfectly smooth on a hood job?

3. What should one do after all the roughing, hand bumping, shrinking, soldering, and welding are done?

4. Why is it generally necessary to remove and hold the hood rigidly during a straightening process?

5. What adjustments are usually provided at the hinges of hoods?

6. If hood misalignment affects its opening what must be done?

7. When the gap between the hood and fenders is too close at both sides, where does the fault lie?

8. What adjustment is made when the gap between the hood and the fender is too large at one side but is normal at the other and the hood opening is too large?

9. Where the hood sets too high all across the rear, what adjustments must be made?

10. When the gap between the hood and fenders is too wide at both sides, what condition exists?

Job 30

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Aligning Hoods		ACW 256-273 ARR 88-92	

1. In most automobiles the front grille work, the two front fenders and the hood form what?

2. What adjustments are usually provided at the hinges of hoods?

3. When aligning a deck lid, is it possible to do any aligning operations with other than a door bar unit?

4. Where is chalk applied in connection with checking deck lid alignment?

5. What happens when the hood is too far forward?

6. What must the contour of the hood match?

7. How is the hood alignment most easily checked?

8. When is proper deck lid alignment said to exist?

9. How is paper used to check the seal between the deck lid and the lower back panel?

10. Name three instances where a rubber mallet can be used to align the deck lid with body contours.

11. At what three places are adjustments provided for properly positioning the hood assembly on Ford built vehicles?

Job 31

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Filing and Sanding		ASM 93-106 ACW 85-89 ARR 21-22, 27-35	

1. Describe a typical auto body file look.
2. What is the difference between a body file and a wood plane?
3. What is the purpose of the shift of the file during the stroke?
4. Define the word picking.
5. What is the beginners problem in picking?
6. For what is a portable disc sander commonly used?
7. Describe a sanding disc.
8. The disc sander has two basic uses in metal finishing, what are they?
9. How are the best results obtained when buffing with the disc sander?
10. What is a good safety measure for the disc sander?
11. Give four uses of the body file.
12. What is a body file holder?

Job 32

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Understanding the Fundamentals of Frame and Body Layout		ASM 274-277	

1. In straightening any body or frame what should the repairman remember?

2. From what two bases is the original layout of any automobile made?

3. In checking the alignment of the frame or body, what should the repairman determine?

4. In what way have the manufacturers of automobiles made checking of the body or frame easier?

5. Where does the engineer work from in making the layout for the frame and the body?

6. What is a centerline?

7. From where does the term centerline come?

8. Where is the datum line located?

9. Does the repairman need a surface plate to measure the datum line?

10. Does the repairman need a datum line gauge?

Job 33

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Straightening Frame Damage		ACW 287-298 ARR 41-48	

1. In general, can the same hydraulic tools be used to apply pressure for frame straightening and also body straightening?

2. What color should a folder frame member be when it is at the proper temperature to be straightened?

3. What damage might occur if an attempt is made to straighten a severely bumped frame without the use of heat?

4. Once you know where to hold and where to apply pressure, how is straightening of a frame best accomplished?

5. What is a simple portable tool available for frame and underbody straightening?

6. How is the heat applied to the frame?

7. What will happen if heat is not properly applied to the bend?

8. Describe the "bow string" method of straightening a frame.

9. Define the word "sag" in the terms of frame alignment.

10. Is a mashed or buckled frame more seriously damaged than either a sagged or swayed frame?

11. What can be affected by misalignment of the frame?

12. What may be the result of using too much heat in frame straightening?

13. How many gauges should be used in determining the misalignment of a frame?

Job 34

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Checking Frame Alignment		ACW 279-284	

1. What is the minimum equipment with which you can check frame alignment?

2. When checking the alignment of the center section of a frame, why is it a good idea to loosen the frame-to-body bolts if the frame does not rest squarely on the horse?

3. What do most passenger automobile frames have in common at the center section?

4. Where does the front section of the frame start?

5. Name four different types of equipment that can be used to check the frame.

6. What is the smooth floor used in frame alignment called?

7. After checking the center section, what is the next checking point?

8. From what points must one always measure?

9. Describe a "self-centering" gauge.

10. When the four corners of the center section are established at the same height from the floor, what is left to check?

Job 35

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Installing and Servicing Door Glass		ACW 31-43 ARR 123-129	

1. What is the function of the weather strip on windshield and rear window glass other than to keep out the weather?

2. How is a door glass held in place so that it can be run up and down evenly?

3. What is the small triangular window incorporated in the front doors of some cars called?

4. Glass often cracks for no apparent reason. What should be done before another glass is installed?

5. How are the windshields and rear windows held in place?

6. Where is the quarter window located?

7. How is sealant-bonded glass installed?

8. Explain the first steps in installing a new glass.

9. Name the general precautions that should be taken whenever any kind of glass is installed.

10. In some cars all of the windows, including windshields and rear windows, are tempered curved glass. How has this come about?

Job 36

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Removing and Installing Windshields		ARR 130-136 ACW 31-40	

1. What is the first step in removing the windshield from the Fisher body?

2. What is usually used to hold garnish molding in place?

3. On some bodies the upper reveal molding is held in position by what means?

4. What must be removed before the windshield reveal molding?

5. How and where are side reveal moldings secured on convertible bodies?

6. After removing windshield what must be checked?

7. How many windshield checking blocks must be installed?

8. What is the first step in removing the windshield on Chrysler built cars?

9. What is used to remove the windshield lower moldings and molding center cap on Chrysler built cars?

10. Outer edge of glass should be a uniform distance from body metal, measured in plane of the glass. What should these dimensions be on a Fisher body?

11. Why is moistened pumice powder used to install sealant-bonded glass?

Job 37

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Replacing and Aligning Roofs		ASM 332-358 ACW 12-23	

1. Why should the roof be removed before individual parts are straightened?

2. What type weld should be used for welding the new roof in place?

3. What is the secret of using force to straighten a body?

4. What is the purpose of the jack in Figure 293 page 347 ASM?

5. What must be done to remove the roof?

6. Describe the roof panel or assembly.

7. How is the roof usually constructed?

8. Most roof panels have stiffeners, what are they?

9. In some special roof designs the roof panel is completely covered with a water proof vinyl plastic. Why is this used?

10. How are the cowl panel and roof panel joined to one another?

Job 38

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Removing and Replacing Trim		ACW 46-55 ARR 111-122	

1. How is an integral door handle and escutcheon assembly held in place?
2. What are escutcheon plates and where are they used?
3. How are the steel strips attached which are used to hold bumpers in place?
4. How are arm rests attached to doors?
5. What doors can usually be locked with a key on an automobile?
6. How are all deck lid handles secured on a vehicle?
7. What are door trim pads?
8. How are all seat mechanisms held in place?
9. In what way are grilles usually constructed?
10. Where are moldings generally used?

Job 39

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Preventing Dust and Water Leaks		ACW 55-59 ARR 203	

1. When traveling in an automobile there is a vacuum created. Where does the vacuum occur?

2. How is vacuum created within the car?

3. Where do dust leaks usually occur?

4. How are panel joints sealed at time of assembly?

5. How are the openings in the cowl panel sealed?

6. At what point of an automobile body is it usually considered possible for water to enter?

7. When should the weather stripping on the doors and deck lid be replaced?

8. If doors do not fit properly, where can dust enter?

9. How are the holes sealed on sports cars that have external mounted deck lid hinges?

10. Where will the air go if it is being drawn in by a vacuum?

11. Name four points that may permit water leakage but are not points of dust leakage.

Job 40

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Servicing Power Seats, Windows and Tops		ARR 137-145	

1. What two types of electrical motors operate power seats, windows, and tops?

2. What may result if the series type motor is operated without a load?

3. What type lubricant is used on frictional surfaces of the transmission?

4. Name some of the frictional surfaces that must be lubricated.

5. What is the first check to be made when trouble shooting power operated seats?

6. What type adjustable seats are used most?

7. Name and describe the motor which General Motor cars use to operate the four-way tilt seat assembly.

8. Describe the adjustable operating mechanism in General Motor's cars.

9. The four-way type power seat installed in Fords is operated on what kind of switch?

10. The wiring harness for the electrically controlled window in most Fisher bodies consists of how many major sections?

11. In Fisher bodies the power windows are operated by what type motor?

12. Describe the power top operation and equipment used in the recent model General Motors cars.

13. Where is the power unit installed in the recent model GM cars?

14. To check the current in the operating circuit in the Ford power top operation what must be done?

Job 41

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Repairing Shields, and Hoods		ACW 60-65	

1. On which panel does the rear of the hood rest?

2. What is the purpose of the flange on the fender?

3. What is the common name for the shield which goes between the bumper and the body proper?

4. What is the panel called which is used behind the front bumper and under the grille?

5. What is the most commonly used type of hood on automobiles?

6. Why is it necessary to know the original dimensions of a panel before it can be restored to its original shape?

7. What is the hood?

8. How is the rear fender bolted to the body?

9. What provision is made for the adjustment of the front fender?

10. What are fenders?

Job 42

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Straightening the Deck Lid		ACW 264-268	

1. How is the deck lid held in place when closed?

2. How is the deck lid supported?

3. Why should the deck lid be removed from the car for repairing?

4. Name one disadvantage you will encounter in working on deck lids.

5. What are some of the necessary tools you will use on a damaged deck lid?

6. With what tools may the first operation in straightening a deck lid be performed?

7. As soon as the surface is comparatively smooth and all sharp ridges have been removed, what is the next step?

8. When the surface has been made as smooth as possible by bumping what is the next step?

9. How are low spots removed after the pick tool has been used?

10. What is the last step in straightening a deck lid?

Job 43

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Aligning Deck Lid		ACW 263-271	

1. When is proper deck lid alignment said to exist?

2. How may the seal between the deck lid and the lower back panel be checked?

3. At what points may the deck lid fail to fit the contour of the body?

4. How may proper deck lid alignment be checked?

5. When aligning a deck lid is it possible to do any aligning operations with other than a door bar unit?

6. When the deck lid does not follow the contour of the roof, but works freely, what is out of line?

7. What tool is used to put the roof panel back to the proper contour?

8. If the misalignment is along the extension panel, above or forward of the tail light openings, how can this be corrected?

9. If proper deck lid alignment is not maintained at all times, what will happen?

Job 44

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Determining when to Repair and when to Replace Parts		ACW 334-345	

1. When reconditioning used cars is it always possible to do a high quality job?

2. Why is it usually possible to reuse interior trim panels after a colision repair?

3. Why are bright metal parts difficult to straighten or weld?

4. What is the principal consideration involved in determining whether to replace a part or repair it?

5. Why is replacement of panels more common on unit construction cars?

6. Why will the uninsured new car owner be different from the insured owner?

7. If you find a part has been filled with solder in the past, what should you do?

8. What is the like-new condition referred to in a collision job?

9. Why is time always a factor in repairing collision jobs?

10. What is the determining factor as to which course you will follow in a repair job?

Job 45

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Using Reinforcements in Body Work		ACW 298-299 ASM 29-32	

1. Why are frames sometimes reinforced before any actual damage has occurred?

2. How are frame reinforcements usually fastened in place?

3. Reinforcements are usually positioned to resist stress in what direction?

4. Reinforcements are of what thickness?

5. When is a reinforcement added to a frame?

6. What are the two basic types of reinforcements?

7. How can maximum strength be obtained when using flanges?

8. The body designers have developed a light weight reinforcement. From what is it made?

9. Why does turning a flange on an edge of a piece of sheet metal have a reinforcing effect?

Job 46

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Making Low Cost Short Duration Repairs		ACW 340-342	

1. What areas of a car body are the most susceptible to rust and damage from road debris which might damage the paint and result in a rusted-out condition?

2. How are replacement panels installed?

3. After the new panel is secured to the old one, what is the next step?

4. When a hole or tear in the metal is mended what should be done?

5. Why is plastic body filler usually used?

6. Name some areas where plastic body filler is used.

7. When applying lead for a body filler what type of flame should be used?

8. What type of paddle should be used to smooth out the lead?

9. What type of lubricant is used on the paddle to keep the lead from sticking to it?

10. How is plastic body filler mixed?

Job 47

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Masking		ARR 151-157, 216 ACW 351-352, 372-374	

1. What areas are covered with masking paper when preparing for painting?

2. Describe good quality masking paper.

3. At what temperatures should masking tape never be applied?

4. In what condition should the surface be to apply masking tape?

5. When is the proper time to remove masking paper?

6. What is needed when masking chrome trim door handles, and similar ornamentation?

7. When covering windshield with masking paper, what part is covered first? Why?

8. For what purpose is an apron taper used?

9. How should a radio antenna be masked?

10. What must be protected when painting the inside of a door jamb?

11. What are masking rings?

12. What is the difference between masking paper and masking tape?

Job 43

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Operating Sanders or Grinders		ARR 27-35, 214, 216 ACW 169-178	

1. Name the three main types of sanders used in the auto body repair work.

2. What two types of disk sanders are available in body work?

3. The conventional portable disk-type sander and grinder are usually available in what sizes?

4. How should the disk sander be held against the auto body?

5. In addition to the electrical safety precautions, operators of grinding equipment should wear what kind of safety equipment?

6. What is the result of heavy pressure on the disk sander?

7. Name two uses of the disk sander.

8. What is the primary use of the oscillating and orbital sanders?

9. Some sanders have a straight reciprocating motion, while others, known as orbital type, have what type motion?

10. Name some of the uses of the belt sander.

11. Why is the disk type sander used on many types of contoured surfaces?

12. How may burned spots caused by sanding be prevented?

13. What are sand scratches?

14. What are abrasives?

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Operating Sanders or Grinders		ARR 27-35, 214, 216 ACW 169-178	

15. Name three natural minerals which are abrasive in nature.

16. What manufactured abrasives may be used?

17. Which of the natural mineral abrasives is the most important?

18. What grit grinding disk is usually used in collision work for removing welds and showing up high and low spots?

19. What grit grinding disk is usually used in collision work for rough grinding?

20. What is the function of a No. 50 close-coat disk in collision work?

21. What are the three ways in which the coarseness or fineness of abrasives is designated?

22. What undesirable condition will be created if only the edge of the disk is allowed to contact the work?

23. Name two methods which are used for applying the abrasive to the backing. Which is the most popular?

24. When grinding on a body panel with a disk grinder, how much of the grinding disk should actually come in contact with the work.

Job 49

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Removing Old Paint		SPC 155-158 ARR 214-217	

1. If the decision is to remove the finish, how can this be accomplished?

2. How is old paint burned off?

3. What are the risks in burning off paint?

4. How are solvent removers applied?

5. When the finish has been removed, what must be done to the surface?

6. What was a favorite stripping material of the old-time finishers?

7. Caustic strippers are safe to use on iron and steel, although they may cause what results to brass or copper?

8. What results will caustic strippers have on aluminum, magnesium, zinc, tin, and soldered points?

9. What type strippers require the use of goggles and rubber gloves?

10. When a finish has been removed with what materials must the surface be carefully washed?

11. Give the meaning of the following terms:

    (1) Butyl Acetate
    (2) Silicon Carbide
    (3) Solvent

Job 50

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Selecting Painting Materials		ARR 158-161, 214-217	

1. What are the two basic ingredients of paints used for automobiles?

2. Why should cars painted with lacquers be repainted with the same material?

3. What are the desirable qualities of acrylic lacquer and enamel?

4. What is the difference in the way enamels and lacquers dry?

5. Why are primer surfacers used?

6. Why are sealers used?

7. What is the difference in the use of thinners and reducers?

8. Why must the area to be painted be absolutely clean?

9. Why are metal conditioners used?

10. Today most cars are refinished in what three materials?

11. What must be done if acrylic lacquer is to be used over enamel?

12. Why do some painters prefer nitrocellulose lacquer?

13. Give the meaning of the following terms:

    (1) Acrylic Resins
    (2) Gloss
    (3) Oxidation

Job 51

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Operating the Air Compressor		SPC 56a-60 ARR 177-181	

1. What effect does being compressed have on air?

2. Explain what happens when an air storage tank is used with the compressor?

3. A portable compressor unit is suited for what type jobs?

4. Describe the air compressor used on a portable compressor unit.

5. Of what does the compact combination compressor unit usually consist?

6. Explain the operation of the automatic electric cut-out.

7. What is the purpose of the air transformer?

8. What are the two basic types of compressors used for spray painting?

9. How often should the air storage tank be drained?

10. For successful spraying it is essential that the gun be supplied with what?

11. What lubrication care should be given to the compressor?

Job 52

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Making Spot Repairs		ACW 369-371 ARR 214-217	

1. What does extreme weathering do to the finish of an automobile?

2. Spot repairs should be made with what type of paint?

3. For what is rubbing compound used?

4. What steps should be taken toward finding the original color on a fender?

5. In making spot repairs, what type of color should always be used?

6. In spot repair, if the paint has worn through to bare metal, what should be done?

7. How does one prepare a place to be spot painted?

8. After the lacquer color coat is applied to a spot repair, what is the next step?

9. What should be done after the spot repair has dried?

10. How is the paint protected after being compounded?

11. Give the meaning of the following terms:

    (1) Chalking
    (2) Cool Colors
    (3) Flash Off
    (4) Garnet Paper
    (5) Metal Conditioner

Job 53

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Operating Spraying Equipment		SPC 49-69 ARR 172-177, 217 ACW 354-369	

1. What is the most important tool used by the sprayer?

2. In what different types of spraying is the modern suction type production spray gun used?

3. What is the chief feature of the suction type spray gun?

4. Describe a pressure-type material tank.

5. Give the principle of operation of material pressure tanks.

6. What inside diameter should the air hose have to give the most efficient performance?

7. Where should the air compressor be located?

8. What is the purpose of the air transformer?

9. How are spraying vapors removed from a shop?

10. What determines the size of the spray booth?

11. How is the paint-and-air stream from a spray gun flattened?

12. Why is a mist coat of lacquer thinner applied in finishing?

13. Why must you avoid using your wrist at either end of the paint stroke?

14. How may the drop in air pressure between transformer and spray gun be checked?

15. Compare the air pressure needed for synthetic enamel and lacquer.

16. How much air per minute does a paint spray gun use?

Job 53 Continued

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Operating the Spraying Equipment		SPC 49-69 ARR 172-177, 217 ACW 354-369	

17. What two adjustments are provided on a spray gun?

18. What is a spray gun?

Job 54

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Using the Proper Technique in Spray Painting		SPC 70-78 ARR 214-217	

1. Who usually makes the most skillful spray painter?

2. Besides a fundamental knowledge of the craft, what must the spray painter thoroughly understand?

3. What is the first required angle in spray painting?

4. What determines the correct distance that the gun should be held from the surface being painted?

5. Why should the trigger be fully back before hitting the surface to be coated?

6. Upon what will the necessary air pressure depend?

7. When spraying an object that is higher than it is wide, such as a refrigerator or radio cabinet, what is the best method?

8. What is one of the most important points in spray gun manipulation?

9. What should be done if the spray operator temporarily sets his work aside intending to resume spraying an hour or so later?

10. What happens when you leave the spray gun in a lacquer thinner over night?

11. Give the meaning of the following terms:

    (1) Mist Coat
    (2) Orange Peel
    (3) Overlap
    (4) Double Coat

Job 55

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Preventing Spray Painting Defects		SPC 83-91 ARR 214-217	

1. What are the main causes of blisters?

2. What causes blushing?

3. What is the cause of bridging?

4. What is the usual cause of checking and cracking?

5. How can discoloration by oil be prevented?

6. What is the remedy for wrinkling?

7. How can runs be prevented?

8. Give the causes of streaks and tell how they can be corrected.

9. Where are wet spots usually found?

10. What is a salt and pepper effect?

11. Give the meaning of the following terms:

    (1) Bleeding
    (2) Checking
    (3) Die Back
    (4) Dry Spray
    (5) Featheredge

Job 56

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Using Synthetic Finishing Materials		SPC 45-48 ARR 214-217	

1. In recent years new types of coatings have been developed, what are they?

2. Synthetic resins are entirely different from the natural resins. Describe them.

3. From what are alkyd resins made?

4. Describe the four types of alkyd generally used for manufacturing finishing materials.

5. What are the best thinners for synthetics?

6. How is the orange-peel effect of synthetic finishes prevented?

7. Synthetics are very versatile and can be adopted to the particular needs of the user much more easily than what others?

8. What are natural resin modified alkyds?

9. How are straight alkyd resins made?

10. What is the advantage of baked finishes?

11. Give the meaning of the following:

    (1) Miscible
    (2) Peeling
    (3) Single coat

Job 57

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Refinishing with Lacquer		SPC 40-44 ARR 214-217	

1. What is a distinctive feature of lacquer?

2. When did nitrocellulose lacquers become widely used?

3. What is lacquer?

4. Lacquer may be considered as consisting of two parts, name them.

5. The bases of most lacquers is nitrocellulose. From what is it made?

6. Why are softeners used with lacquers?

7. Why is the boiling point of solvents important in making lacquers?

8. Why are gums and resins used in lacquer?

9. Occasionally the spray operator may need a small amount of a particular color of lacquer on short notice. Can he mix his own colors, and if so, how?

10. Lacquer sealer performs three functions. Name them.

11. What are lacquer enamels?

12. Give the meaning of the following:

    (1) Tack Coat
    (2) Tack Rag
    (3) Tolvol
    (4) Warm Colors

Job 58

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Refinishing Wheels		IS 58a	

1. To do the best job on refinishing wheels, what should be done to them?

2. What is another method used to remove old paint?

3. What type of solution is used to boil them in?

4. What should be done to the wheels after they have been boiled?

5. If the wheels are in fair condition, what will be sufficient to do to them?

6. What is a big help in working on wheels to hold them in a good position while refinishing?

7. How many coats of lacquer are required?

In refinishing metal wheels on the best jobs, it is well worth the trouble and expense to send them out for sand blasting if they are in very bad condition. However, with patience, a motor driven wire brush or sander will get them in shape for refinishing.

Another method frequently used is that of boiling them in a caustic solution, and old oil barrel sometimes being used as a vat. By filling this vat with caustic solution and boiling the wheels two at a time all old paint and grease will be removed. Then the wheels should be rinsed with clear water, rust sanded off, and the entire wheel wiped off with a rag moistened with high test gasoline.

If the wheels are in fair condition, it will be sufficient to sand them well all over.

A pipe stand made of 1" pipe is a big help when working on wheels. The horizontal pipe on which the wheel rests should be about 12" long and 40" from the floor. The cap on the end of this pipe will be sufficient to keep wheels from slipping off while being turned.

The exact number of coats will depend upon the condition of the surface.

Job 59

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Refinishing Inside Molding, Instrument Panels, etc.		IS - 59a	

1. Name the three types of refinishing jobs which may be done on the instrument panel and the garnish molding around the windshield, windows, door glasses, etc.

2. What tools are used in graining to produce the grained effect?

3. Which is used most satisfactorily on a small spot to be regrained?

4. What type of graining color should be used?

5. In using chassis black what can be done if the grain pattern produced does not give the desired effect?

6. Which of the two effects, strippled or swirled, is the easiest for the beginner?

7. Describe the procedure used in refinishing the instrument panel and garnish molding in a solid color. (No graining.)

8. Name two advantages of the grained transfers.

9. In covering the instrument panel with a grained transfer, why is it important to cover the whole panel or a section up to a break in the section?

10. What application goes on top of the graining color?

Whether the instrument panel, garnish moldings etc., are to have the finish repaired or whether they are to be completely refinished will depend largely on the condition of the old finish. It is also possible that the old color on the panel and the garnish moldings might not look well with the new color of the body and would need refinishing merely for change of color to make the inside color harmonize with the new body coat. Obviously, the procedure followed would depend entirely upon the job to be done. The following information on procedure to be followed in refinishing instrument panels and garnish moldings is therefore grouped under 3 headings--(A) repairing a grained wood finish; (B) complete refinishing and hand graining; and (C) refinishing the panel and moldings by applying a grained transfer.

A. Procedure for repairing a grained wood finish.

1. If refinishing a garnish molding, it must first be removed.
2. If the finish has been worn off to the metal sand the surface and featheredge the old finish around the spot.
3. Wash the molding with naphtha to remove wax and grease.
4. When thoroughly clean and dry apply a lacquer primer to the bare metal spot.
5. Apply lacquer ground coat the same color as that already on undamaged portion.
6. Apply graining color in one of two ways--either with a stencil brush or with a piece of cloth (cheese cloth or old wash cloth). Either a swirled effect or a stippled effect may be gotten with the cloth. If the spot to be regrained is small the stencil brush will probably work better than the cloth. The graining color must be a rather fast drying material. Asphaltum, water colors or "chassis black" may be used in graining. Use gasoline on the rag as thinner with the chassis black.

   A stippled effect may be gotten by stippling with the brush or it may be produced by first rubbing a thin coat of graining color on the molding and then as it begins to set up either daub it with the cloth or roll the cloth over it. The swirled effect may be produced by skillfully slipping the rag back and forth over the molding holding the rag at the ends and using a motion similar to the motion used in shining shoes. As the rag is moved back and forth, slowly cause it to travel all the way across the spot. The stippling is the easiest operation to master; good swirl effects can come only after practice.

Continued. . . .

In case the first try does not produce the desired pattern the chassis black may be washed off with gasoline and a new start made. The chassis black put on with a rag wet with gasoline produces a dark brown color over the ground color.

7. When the desired grain pattern has been produced (it may take several trys before it gives the desired effect) and the color is thoroughly dry, cover it with clear lacquer or a tinted lacquer whichever gives the desired shade or tone. The clear is usually acceptable and must be applied very lightly to avoid lifting the graining color.
8. After approximately 4 hours drying time rub with a rubbing compound. (Note: If the spot to be regrained still has the original ground coat it may be washed with the wax and grease solvent then refinished as described in Nos. 6, 7, and 8.)

B. Completely refinishing the instrument panel, and garnish moldings.

On some refinishing jobs the instrument panel and garnish moldings may be refinished in a solid color of some neutral shade which will harmonize satisfactorily with both the upholstery and the outside colors. This work should be done according to the procedures used in refinishing the outside of the car.

If regraining is to be done the procedure would be the same as that used in repairing a grained wood finish except that the work would be done over the whole panel and moldings instead of on a spot.

C. Refinishing the instrument panel and garnish molding by applying a grained transfer.

Grained transfers may be bought and applied to instrument panels and garnish moldings. Transfers of this type are applied on many of the new automobiles in the factory. Compared to hand graining, the transfers give a nicer appearance if applied correctly and they are very durable.

The transfer should be applied over the entire panel or at least large enough to reach to a breaking off section so as not to show a noticeable break in the transfer surface.

These transfers are made by several companies. Following is the procedure for applying one of the types of transfers made and sold for such purposes.

Continued. . . .

HOW TO APPLY DI-NOC (FLAT) TRANSFER

1. Featheredge the damaged transfer and clean the surface of instrument panel thoroughly.

2. Dip transfer in clear water for at least three seconds.

3. Immediately submerge transfer completely in transfer solution.

4. Apply transfer to panel, smooth as much as possible, and remove paper backing.

5. Using rubber squeegee, smooth out transfer to remove all wrinkles and air bubbles. If an air bubble remains, prick it with a needle.

6. Wipe transfer dry and allow to air dry for one hour.

7. Spray one coat of clear lacquer to transfer and air dry for thirty (30) minutes in a warm room.

8. Sandpaper transfer lightly with No. 400 grit paper and polish with body polishing compound.

Job 60

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Refinishing Metal		ACW 346-379	

1. The major materials that you will be using in refinishing fall into two groups. What are they?

2. What is the purpose of feather edging? What kind of paper is used? What grit number?

3. How do you keep the spray gun hose from rubbing on the new paint?

4. What is the grit paper number used for sanding the old paint?

5. What is putty glazing?

6. What is the function of the primer-surfacer?

7. How does the water help when sanding old paint?

8. Why should an automotive painter have some knowledge of metal finishing?

9. How long should you wait before removing the masks from a car that has just had the paint baked on?

10. Ordinarily, what kind of primer-surfacer would be used as a foundation for a finishing coat of lacquer?

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Mixing Paint and Matching Colors		ARR 165-171, 214-216	

1. What is the cause of many paint failures?

2. Why do color pigments settle to the bottom of a can of paint?

3. Why is it necessary to add thinners or reducers to commercial paints?

4. How can the painter determine the correct amount of thinner to add to lacquer, enamel or acrylic?

5. What effect does rubbing and polishing have on the fading of automobile colors?

6. How may the distance a spray gun is held from the surface to be painted affect the color of the paint?

7. How may the painter check for difference in color between paint to be used and original color?

8. Why are colors in enamel more difficult to match?

9. Why must thinner or reducer be added slowly?

10. Give the meaning of the following terms:

    (1) Color retention
    (2) Enamel
    (3) Paint film
    (4) Pigment
    (5) Reducer

Job 62

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Estimating the Cost of Auto Body Work		ACW 342-345	

1. What does the word estimating mean in collision work?

2. What does the word "firm" mean in collision work?

3. What will happen if you "hedge" on your estimates?

4. Actually, what is an estimate in collision work?

5. What controls the discount a shop owner can offer?

6. Upon what is the cost of labor in an estimate based?

7. What is the retail rate in collision work?

8. How much should a highly skilled collision man be worth?

9. Upon what is an estimate based?

10. Where may a shop owner obtain a flat rate time schedule?

11. When should a shop owner quit using flat rate time schedules and use his own figures?

Job 63

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Repairing Fiber Glass Bodies		ARR 83-87	

1. How are the fiber glass bodies formed?

2. What is fiber glass?

3. What are the first three steps that should be used in repair of reinforced fiber glass parts?

4. How is resin activated?

5. In case resin tends to cause skin irritation, what is recommended?

6. What is used to remove resin from tools, clothing, or hands?

7. When the fiber glass patch is hardened, what should be done?

8. If external heat is used to speed hardening, what should be the maximum degree to heat the area?

9. In resin preparation, give the formula which will harden in 30 minutes.

10. What will result if catalyzed resin is left standing too long?

Job 64

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Customizing Auto Bodies		ARR 195-198	

1. What is the basic procedure when altering the lines of an auto body?

2. What is the purpose of the wire mesh when customizing?

3. How is the wire mesh held in place on the automobile?

4. What is an excellent method to use when a form is required in duplicate?

5. What agent is used when sealing a form?

6. What is used to build a form when building a complete body?

7. How many square feet of cloth will one gallon of resin cover?

8. How thick is matte?

9. How are the brackets mounted to the body?

10. How is the body reinforced after it is completed?

Job 65

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Servicing Door Hardware		ARR 100-110	

1. What is usually classified as door hardware?

2. On Fisher bodies, what is used to hold the front and rear door inside handles in position?

3. How are the retaining clips on the Fisher bodies removed?

4. When must the door arm rest on Fisher bodies be removed in order to remove door handles?

5. What are the steps in removing the front or rear outside door handles on recent Fisher bodies?

6. How is the access hole reached on the Fisher front door lock assembly?

7. When removing the inside door handle on Ford cars, what type tool is usually employed?

8. How is the rear door lock removed on a Ford car?

9. With what type wrench are the inside door handles on Chrysler bodies removed?

10. By what procedure is the remote control and door lock on a Chrysler removed?

Job 66

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Recovering Convertible Tops		ARR 146-147	

1. In the case of Ford cars, of what does the convertible top consist?

2. What is the advantage of bonded seams?

3. When removing the top fabric what should be done first?

4. How do you gain access to the underside of the front bow?

5. What is removed first when installing a new top fabric?

6. What is used to secure the flaps to the underside of the side rail?

7. What is used to secure the end of the trim to the pivot bracket supports?

Job 67

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Cleaning Upholstery		ARR 206-210	

1. How should dust and dirt be removed from upholstery and floor?

2. What four types of materials are used to upholster seats in automobiles?

3. Why should whisk brooms never be used on fabrics having a raised tapestry?

4. Why should stains be removed as soon as possible after they are made?

5. What are the four basic types of cleaners used for removing spots and stains?

6. What precautions should be taken when using volatile cleaners?

7. What is used for cleaning leather and coated fabrics?

8. How is a floor carpet fluffed after cleaning?

9. What can be used to remove stains caused by battery acid?

10. How may stains caused by chocolate be removed?

11. Describe the proper method of removing grease and oil.

12. Why is lipstick very difficult to remove?

Job 68

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Removing and Installing Headlining		ARR 113-118, 215	

1. What is the headlining?

2. Where are the ends of the listing wire located on the headlining assembly of recent Fisher bodies?

3. How are headliners secured at the windshield on recent model Fisher bodies?

4. What is the first protective step in removing headlining from recent model Fisher bodies?

5. When replacing headlining, how should listing wires be placed?

6. How may listing wires be adjusted?

7. What is the important factor in ordering new roof bows?

8. Describe the tool used when pulling on fabric upholstery material.

9. When ordering new bows for the Ford headlining, what is necessary to note for each bow?

10. Where do you start installing the headlining of a Chrysler?

11. What tool is used to tuck the first and second seam between the roof side rail and retainer on a Chrysler?

Job 69

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Aligning Wheels		ARR 199-202	

1. What is the key to good steering control?
2. What must be used to obtain correct wheel alignment?
3. Name some of the more common causes of steering and suspension troubles.
4. Describe the meaning of caster.
5. In what direction does caster tend to stabilize the steering?
6. What is positive caster?
7. What is negative caster?
8. How can caster be adjusted to the manufacturer's specifications?
9. What is meant by the word camber?
10. By what means may camber be adjusted?
11. What is meant by toe-in?
12. Give six causes of hard steering.

Job 70

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Maintaining the Auto Body		ARR 203-210	

1. What are the principle methods used to locate water and dust leaks?

2. How is a check made for correct positioning of the weather strip around door and deck lid weather stripping?

3. What is one of the major causes of rusted auto body panels?

4. Where are drain holes located?

5. What is the cause of most rattles?

6. What should be used to lubricate all rubber bumpers on rails and cowls?

7. Dusting the outside finish when it is dry tends to do what to the finish?

8. What causes chrome plated parts to rust or corrode?

9. What are the basic types of cleaners commonly used for removing spots and stains from automotive upholstery materials?

10. What should be used to remove battery acid?

Job 71

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Safety in the Auto Body Shop		ARR 211-212	

1. Name one of the basic rules of safety in any shop.

2. When using sanders or grinders, what safety protection should auto-body men always wear?

3. Files should never be used without what type handles?

4. The grinding wheel should be provided with what?

5. When the head of a chisel becomes swagged over, what must be done to it?

6. Why are the possibilities of accidents greater in the body shop than in other departments?

7. Why should paints and thinners be kept in closed containers?

8. Why should the battery be disconnected on wrecked automobiles brought into a shop?

9. Why should the body shop be well lighted?

10. Why is it best to push a wrench instead of pulling it?

11. What safety rule should be observed when using the air gun?

Job 72

TYPE JOB	LABORATORY PERFORMANCE	RELATED STUDY REFERENCES	DATE READ
Repairing Unitized Bodies		ACW 24-27, 276-277, 285-289 ASM 359-392	

1. What is the advantage of portable frame straightening equipment?

2. What is meant by unitized construction?

3. Why must a damaged frame side rail be exactly realigned?

4. What can be done to avoid tearing or collapsing one section of metal in an attempt to straighten a severe buckle behind it?

5. What parts make up the underbody of a unitized body?

6. What is the difference between the floor pan of the unitized body and that of the conventional body?

7. What is the purpose of the master locating hole in the frame of a unitized body?

8. What gauges are used to determine underbody alignment of unitized bodies?

9. What may be the effect of underbody misalignment on controlling the car?

10. Why should heat be used in frame straightening?